

Claims

5 1. A system for determining a guaranteed productivity support agreement for a customer, comprising:

at least one machine sensor adapted to provide at least one machine sensor signal indicative of the work performed by the machine;

10 at least one computer adapted to receive the sensor signal, calculate the productivity of the machine, and

15 select a guaranteed productivity customer support agreement in response to the productivity.

20 2. The system of claim 1, wherein the computer is adapted to determine whether the productivity of the machine is deteriorating and provide a productivity deterioration warning notice signal in response to determining the productivity of the machine is deteriorating.

25 3. A system for providing at least one work machine to a customer, comprising:

at least one machine sensor adapted to provide at least one machine sensor signal indicative  
✓ of the operation performed by the machine, the payload  
✓ handled by the machine and the amount of fuel consumed  
30 by the machine; and

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a computer adapted to  
receive the sensor signal,  
calculate the productivity of the  
machine,

5 select and generate a guaranteed  
productivity customer support agreement in  
response to the productivity of the machine,  
monitor the productivity of the  
machine,

10 determine whether the productivity of  
the machine is deteriorating, and  
provide a productivity deterioration  
warning notice signal in response to determining  
the productivity of the machine is deteriorating.

15 4. The system of claim 3, wherein the  
machine sensor includes at least one operation sensor  
adapted to provide at least one operating sensor  
signal indicative of the operation performed by the  
20 machine, at least one payload sensor adapted to  
provide at least one payload sensor signal indicative  
of the payload handled by the machine and at least one  
fuel sensor adapted to provide at least one fuel  
consumption sensor signal indicative of the amount of  
25 fuel consumed by the machine.

5. The system of claim 4, including at  
least one data storage device adapted to store on a  
storage medium information including empirical data,  
30 values representing the sensor signals and normalized

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operator productivity data for at least one work cycle  
and wherein the computer is adapted to compare the  
sensor signals to the empirical data to determine a  
work cycle performed by the machine, determine a skill  
✓ 5 level of the operator and provide a skill level notice  
signal, the skill level of the operator being  
determined by comparing the productivity of the  
machine with the normalized operator productivity data  
✓ for the work cycle and calculate the change in the  
10 productivity of the machine and skill level of the  
operator, the data storage device being adapted to  
store the change in the productivity of the machine  
and skill level of the operator.

15 6. A system for providing at least one  
work machine controlled by at least one operator to a  
customer, comprising:  
at least one operation sensor adapted to  
provide at least one operating sensor signal  
20 ✓ indicative of the operation performed by the machine;  
at least one payload sensor adapted to  
provide at least one payload sensor signal indicative  
✓ of the payload handled by the machine;  
at least one fuel sensor adapted to provide  
25 at least one fuel consumption sensor signal indicative  
✓ of the amount of fuel consumed by the machine;  
at least one data storage device adapted to  
store on a storage medium information including  
empirical data, values representing the sensor  
30 signals, normalized operator productivity data for at

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least one work cycle, normalized expected improvement  
in skill level data for at least one work cycle and at  
least one guaranteed productivity customer support  
agreement having at least one minimum productivity  
5 limit and corresponding price;

a computer including a CPU adapted to  
receive the sensor signals,  
compare the sensor signals to the  
empirical data to determine a work cycle  
10 performed by the machine,  
✓ a) calculate the productivity of the  
machine and provide a productivity notice signal,  
the productivity being a function of an amount of  
fuel consumed and at least one of a payload  
15 handled by the machine and an operation performed  
by the machine,

determine a skill level of the operator  
and provide a skill level notice signal, the  
skill level of the operator being determined by  
20 comparing the productivity of the machine with  
the normalized operator productivity data for the  
work cycle,

select and generate the guaranteed  
productivity customer support agreement  
25 establishing at least one minimum productivity  
limit and corresponding price in response to the  
skill level,

44 monitor the machine,

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continuously calculate the productivity of the machine and determine the skill level of the operator,

✓  
5 calculate the change in the productivity of the machine and skill level of the operator, the data storage device being adapted to store the change in the productivity of the machine and skill level of the operator,

10 determine whether the productivity of the machine is deteriorating as a function of at least one of the change in the productivity of the machine, the change in the skill level of the operator and the normalized expected improvement in skill level data,

15 provide a productivity deterioration warning notice signal in response to determining the productivity of the machine is deteriorating,

20 provide a service notice signal in response to the step of determining whether the productivity of the machine is deteriorating,

provide an agreement warning notice signal in response to the step of determining whether the productivity of the machine is deteriorating and considering the limit,

25 generate at least one message record, the message record including at least one of the signals and notice signals, and

30 the data storage device being adapted to store values representing the message record; and

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at least one communication device adapted to receive the message record and provide the message record to at least one of the operator, a service organization, the customer and an owner of the  
5 machine.

7. A method of determining a guaranteed customer support agreement for a customer, the method comprising the steps of:  
10 ✓ determining the productivity of the machine;  
and  
generating a guaranteed productivity customer support agreement establishing at least one minimum productivity limit.

15 8. The method of claim 7, wherein an operator operates the machine and including the step of determining a skill level of the operator.

20 9. The method of claim 8, including the steps of determining whether the productivity of the machine is deteriorating and communicating a productivity deterioration warning notice to at least one of the operator, a service organization, the  
25 customer and an owner of the machine.

10. A method of providing at least one work machine to a customer, the method comprising the steps of:

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✓ determining the productivity of the machine,  
the productivity being at least a function of a time  
period, a fuel consumed and at least one of a payload  
handled by the machine and an operation performed by  
5 the machine;

✓ determining a skill level of the operator;  
generating a guaranteed productivity  
customer support agreement establishing at least one  
minimum productivity limit and corresponding price in  
10 response to the skill level;

determining whether the productivity of the  
machine is deteriorating; and

communicating a productivity deterioration  
warning notice to at least one of the operator, a  
15 service organization, the customer and an owner of the  
machine.

11. The method of claim 10, including the  
steps of monitoring the operation of the machine and  
20 determining a work cycle performed by the machine.

12. The method of claim 11, wherein the  
machine is operated by an operator and including the  
steps of comparing the productivity of the machine  
25 with normalized operator productivity data for the  
work cycle and determining a skill level of the  
operator in response to the step of comparing the  
productivity of the machine with the productivity  
data.

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13. The method of claim 12, including the steps of performing comparisons of the productivity of the machine with the productivity data and determining the change in the skill level of the operator in response to the step of performing subsequent comparisons of the productivity of the machine with the productivity data.

14. The method of claim 13, including the step of providing an incentive to the operator for at least achieving a predetermined change in skill level, such predetermined change in skill level being determined by considering a normalized expected improvement in skill level, and the incentive being at least one of a reward, penalty, compensation, and failure to impose at least one of a reward, penalty and compensation.

15. The method of claim 13, including the steps of determining a productivity deterioration warning notice in response to performing subsequent comparisons of the productivity of the machine with the productivity data and considering the normalized expected improvement in skill level, determining a service notice in response to the step of determining whether the productivity of the machine is deteriorating and determining an agreement warning in response to the step of determining whether the productivity of the machine is deteriorating and considering the limit.

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16. The method of claim 15, including the step of generating at least one message record and including in the message record a signal indicative of at least one of the productivity, skill level, service notice, agreement warning, productivity deterioration warning notice, time period, fuel consumed, payload handled by the machine and the operation performed by the work machine.

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17. A method of providing at least one work machine controlled by at least one operator to a customer, the method comprising the steps of:

✓ monitoring the operation of the machine;  
15 determining a work cycle performed by the machine;

determining the productivity of the machine, the productivity being at least a function of a time period, a fuel consumed and at least one of a payload handled by the machine and an operation performed by the machine;

20 comparing the productivity of the machine with normalized operator productivity data for the work cycle;

25 determining a skill level of the operator in response to the step of comparing the productivity of the machine with the productivity data;

generating a guaranteed productivity customer support agreement establishing at least one

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minimum productivity limit and corresponding price in  
response to the skill level;

monitoring the machine;

performing subsequent comparisons of the  
5 productivity of the machine with the productivity  
data;

determining the change in the skill level of  
the operator in response to the step of performing  
subsequent comparisons of the productivity of the  
10 machine with the productivity data;

providing an incentive to the operator for  
at least achieving a predetermined change in skill  
level, such predetermined change in skill level being  
determined by considering a normalized expected  
15 improvement in skill level, and the incentive being at  
least one of a reward, penalty, compensation, and  
failure to impose at least one of a reward, penalty  
and compensation;

determining whether the productivity of the  
20 machine is deteriorating and determining a  
productivity deterioration warning notice in response  
to performing subsequent comparisons of the  
productivity of the machine with the productivity data  
and considering the normalized expected improvement in  
25 skill level;

determining a service notice in response to  
the step of determining whether the productivity of  
the machine is deteriorating;

determining an agreement warning in response  
30 to the step of determining whether the productivity of

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the machine is deteriorating and considering the limit;

- generating at least one message record;
  - including in the message record a signal
- 5 indicative of at least one of the productivity, skill level, service notice, agreement warning, productivity deterioration warning notice, time period, fuel consumed, payload handled by the machine and the operation performed by the work machine; and
- 10 communicating the message record to at least one of the operator, a service organization, the customer and an owner of the machine.

18. A work machine adapted to be controlled  
15 by an operator and for acting upon a load through a plurality of work cycles, comprising:

- a frame;
- a plurality of ground engaging devices supporting the frame;
- 20 an operator compartment supported by the ground engaging devices;
- an implement having a linkage for operably connecting the implement to the frame;
- an engine operably coupled to the ground
- 25 engaging devices; and
- a system for determining a guaranteed productivity support agreement for a customer, including:

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at least one machine sensor adapted to  
provide at least one machine sensor signal indicative  
of the work performed by the machine;

5                   at least one computer adapted to  
                  receive the sensor signal,  
                  calculate the productivity of the  
                  machine, and  
                  select a guaranteed productivity  
                  customer support agreement in response to the  
10                   productivity.

19. The work machine of claim 18, wherein  
the computer is adapted to determine whether the  
productivity of the machine is deteriorating and  
15                   provide a productivity deterioration warning notice  
                  signal in response to determining the productivity of  
the machine is deteriorating.

20. A work machine adapted to be controlled  
20                   by an operator and for acting upon a load through a  
plurality of work cycles, comprising:

                  a frame;  
                  a plurality of ground engaging devices  
supporting the frame;  
25                   an operator compartment supported by the  
ground engaging devices;  
                  an implement having a linkage for operably  
connecting the implement to the frame;  
                  an engine operably coupled to the ground  
30                   engaging devices; and

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a system for measuring operator productivity of at least one work machine for a customer, including:

- 5                   at least one machine sensor adapted to provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine;
- 10                   at least one data storage device adapted to store information on a storage medium;
- a computer adapted to receive the sensor signals, calculate the productivity of the machine, the productivity being a function of an amount of fuel consumed and at least one of a payload handled by the machine and an operation performed by the machine,
- 15                   calculate the change in the productivity of the machine, the data storage device being adapted to store the change in the productivity of the machine; and
- 20                   determine whether the productivity of the machine is deteriorating.

25

21. A system for measuring operator productivity of at least one work machine for a customer, comprising:

- 30                   at least one machine sensor adapted to provide at least one machine sensor signal indicative

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of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and

5           a computer including a CPU adapted to  
          receive the sensor signals and  
          calculate the productivity of the  
machine, the productivity being a function of an  
amount of fuel consumed and at least one of a  
payload handled by the machine and an operation  
10           performed by the machine.

22. The system of claim 21, wherein the  
computer is adapted to calculate the change in the  
productivity of the machine.

15           23. A system for measuring operator  
productivity of at least one work machine for a  
customer, comprising:

          at least one machine sensor adapted to  
20       provide at least one machine sensor signal indicative  
of the operation performed by the machine, the payload  
handled by the machine and the amount of fuel consumed  
by the machine;

          at least one data storage device adapted to  
25       store information on a storage medium;

          a computer adapted to  
          receive the sensor signals,  
          calculate the productivity of the  
machine, the productivity being a function of an  
30       amount of fuel consumed and at least one of a

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payload handled by the machine and an operation performed by the machine,

calculate the change in the productivity of the machine, the data storage device being adapted to store the change in the productivity of the machine; and

determine whether the productivity of the machine is deteriorating.

24. The system of claim 23, wherein the machine sensor includes at least one operation sensor adapted to provide at least one operating sensor signal indicative of the operation performed by the machine, at least one payload sensor adapted to provide at least one payload sensor signal indicative of the payload handled by the machine and at least one fuel sensor adapted to provide at least one fuel consumption sensor signal indicative of the amount of fuel consumed by the machine.

25. The system of claim 24, wherein the information includes empirical data, values representing the sensor signals, normalized operator productivity data for at least one work cycle and the computer is adapted to compare the sensor signals to the empirical data to determine a work cycle performed by the machine, determine a skill level of the operator and provide a skill level notice signal, the skill level of the operator being determined by comparing the productivity of the machine with the

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normalized operator productivity data for the work cycle, calculate the change in the skill level of the operator and determine whether the productivity of the machine is deteriorating as a function of at least one  
5 of the change in the productivity of the machine, the change in the skill level of the operator and the normalized expected improvement in skill level.

26. The system of claim 25, wherein the  
10 computer is adapted to provide a productivity deterioration warning notice signal in response to determining the productivity of the machine is deteriorating and generate at least one message record including the notice signal, the data storage device  
15 is adapted to store values representing the message record and at least one communication device is adapted to receive the message record and provide the message record to at least one of the operator, a service organization, the customer and an owner of the  
20 machine.

27. A method of providing incentives to an operator of a work machine, the method comprising the steps of:  
25 determining a work cycle performed by the machine;  
determining the productivity of the machine;  
comparing the productivity of the machine  
with normalized operator productivity data for the  
30 work cycle;

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determining a skill level of the operator in response to the step of comparing the productivity of the machine with the productivity data;

5 determining the change in the skill level of the operator in response to comparing the productivity of the machine with the productivity data; and

providing an incentive to the operator for at least achieving a predetermined change in skill level.

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28. The method of claim 27, including the steps of generating at least one message record including a signal indicative of the skill level and communicating the message record to at least one of  
15 the operator, a service organization, a customer and an owner of the machine

29. A method of providing incentives to an operator of a work machine, the method comprising the  
20 steps of:

determining a work cycle performed by the machine;

determining the productivity of the machine, the productivity being at least a function of a time  
25 period, a fuel consumed and at least one of a payload handled by the machine and an operation performed by the machine;

comparing the productivity of the machine with normalized operator productivity data for the  
30 work cycle;

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determining a skill level of the operator in response to the step of comparing the productivity of the machine with the productivity data;

5 determining the change in the skill level of the operator in response to comparing the productivity of the machine with the productivity data;

10 providing an incentive to the operator for at least achieving a predetermined change in skill level, such predetermined change in skill level being determined by considering a normalized expected improvement in skill level, and the incentive being at least one of a reward, penalty, compensation, and failure to impose at least one of a reward, penalty and compensation;

15 determining whether the productivity of the machine is deteriorating and determining a productivity deterioration warning notice in response to performing subsequent comparisons of the productivity of the machine with the productivity data and considering the normalized expected improvement in skill level;

20 generating at least one message record including a signal indicative of the skill level; and communicating the message record to at least one of the operator, a service organization, a customer and an owner of the machine.

30. A system for determining when a work machine needs service, comprising:

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at least one machine sensor adapted to provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and

a computer adapted to receive the sensor signals, calculate the productivity of the machine, determine a skill level of the operator, calculate the change in the productivity of the machine and skill level of the operator, determine whether the productivity of the machine is deteriorating and provide a service notice signal in response to the step of determining whether the productivity of the machine is deteriorating.

31. The system of claim 30, wherein whether the productivity of the machine is deteriorating is determined as a function of at least one of the change in the productivity of the machine, the change in the skill level of the operator and the normalized expected improvement in skill level data.

32. The system of claim 30, wherein the computer is adapted to generate at least one message record, the message record including the service notice signal and including at least one communication device adapted to receive the message record and provide the message record to at least one of the operator, a service organization, the customer and an owner of the machine.

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33. A system for determining when a work machine needs service, comprising:

5 at least one machine sensor adapted to provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and

10 at least one data storage device adapted to store on a storage medium information including normalized operator productivity data for at least one work cycle and normalized expected improvement in skill level data;

15 a computer adapted to receive the sensor signals, calculate the productivity of the machine,

20 determine a skill level of the operator, the skill level of the operator being determined by comparing the productivity of the machine with the normalized operator productivity data for the work cycle,

25 calculate the change in the productivity of the machine and skill level of the operator,

determine whether the productivity of the machine is deteriorating as a function of at least one of the change in the productivity of the machine, the change in the skill level of the

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operator and the normalized expected improvement  
in skill level data,

5 provide a service notice signal in  
response to the step of determining whether the  
productivity of the machine is deteriorating,  
generate at least one message record,  
the message record including the  
service notice signal; and

10 at least one communication device adapted to  
receive the message record and provide the message  
record to at least one of the operator, a service  
organization, the customer and an owner of the  
machine.

15 34. The system of claim 33, wherein the  
productivity is a function of an amount of fuel  
consumed and at least one of a payload handled by the  
machine and an operation performed by the machine.

20 35. A work machine adapted to be controlled  
by an operator and for acting upon a load through a  
plurality of work cycles, comprising:

25 a frame;  
a plurality of ground engaging devices  
supporting the frame;  
an operator compartment supported by the  
ground engaging devices;  
an implement having a linkage for operably  
connecting the implement to the frame;

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an engine operably coupled to the ground  
engaging devices; and

a system for determining fees to be paid by  
a customer that are based on machine productivity,  
5 including:

at least one machine sensor adapted to  
provide at least one machine sensor signal indicative  
of the operation performed by the machine, the payload  
handled by the machine and the amount of fuel consumed  
10 by the machine; and

a computer adapted to receive the sensor  
signals, calculate the productivity of the machine,  
determine a skill level of an operator of the machine,  
the skill level of the operator being determined by  
15 comparing the productivity of the machine with the  
normalized operator productivity data for the work  
cycle, and select an agreement establishing a price in  
response to the skill level.

20 36. The work machine of claim 35, wherein  
the productivity is a function of an amount of fuel  
consumed and at least one of a payload handled by the  
machine and an operation performed by the machine.

25 37. The work machine of claim 35, wherein  
the agreement establishes at least one minimum  
productivity limit and corresponding price.

30 38. The work machine of claim 35, including  
at least one communication device adapted to receive

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the price and provide the price to at least one of the operator, a service organization, the customer and an owner of the machine.

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- a frame;
  - a plurality of ground engaging devices
  - 10 supporting the frame;
  - an operator compartment supported by the ground engaging devices;
  - an implement having a linkage for operably connecting the implement to the frame;
  - 15 an engine operably coupled to the ground engaging devices; and
  - a system for determining when a work machine needs service, including:
    - at least one machine sensor adapted to
    - 20 provide at least one machine sensor signal indicative of the operation performed by the machine, the payload handled by the machine and the amount of fuel consumed by the machine; and
    - a computer adapted to receive the sensor
    - 25 signals, calculate the productivity of the machine, determine a skill level of the operator, calculate the change in the productivity of the machine and skill level of the operator, determine whether the productivity of the machine is deteriorating and
    - 30 provide a service notice signal in response to the

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step of determining whether the productivity of the machine is deteriorating.

40. The work machine of claim 39, wherein  
5 whether the productivity of the machine is  
deteriorating is determined as a function of at least  
one of the change in the productivity of the machine,  
the change in the skill level of the operator and the  
normalized expected improvement in skill level data.

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41. The work machine of claim 39, wherein  
the computer is adapted to generate at least one  
message record, the message record including the  
service notice signal and including at least one  
15 communication device adapted to receive the message  
record and provide the message record to at least one  
of the operator, a service organization, the customer  
and an owner of the machine.

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42. A system for determining fees to be  
paid by a customer that are based on machine  
productivity, comprising:

at least one machine sensor adapted to  
provide at least one machine sensor signal indicative  
25 of the operation performed by the machine, the payload  
handled by the machine and the amount of fuel consumed  
by the machine; and

a computer adapted to receive the sensor  
signals, calculate the productivity of the machine,  
30 determine a skill level of an operator of the machine,

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the skill level of the operator being determined by  
comparing the productivity of the machine with the  
normalized operator productivity data for the work  
cycle, and select an agreement establishing a price in  
5 response to the skill level.

43. The system of claim 42, wherein the  
productivity is a function of an amount of fuel  
consumed and at least one of a payload handled by the  
10 machine and an operation performed by the machine.

44. The system of claim 42, wherein the  
agreement establishes at least one minimum  
productivity limit and corresponding price.  
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45. The system of claim 42, including at  
least one communication device adapted to receive the  
price and provide the price to at least one of the  
operator, a service organization, the customer and an  
20 owner of the machine.

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